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Upper Rio Grande 2028 Regional Flood Plan

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From:
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To: Texas Water Development Board (TWDB)

Cc: Upper Rio Grande Regional Flood Planning Group (RFPG)

Memo

Subject: Upper Rio Grande Regional Flood Plan Technical Memorandum (Task 4B)

AECOM is providing engineering services for the Rio Grande Council of Governments (RGCOG) as part of the Region 14 Upper Rio Grande Regional Flood Plan (RFP) Cycle 2, administered by the Texas Water Development Board (TWDB). This regional flood plan will be incorporated into the second planning cycle of the State Flood Plan for Texas.

The primary objective of the Upper Rio Grande RFP is to identify specific flood risks within the region and to identify, evaluate, and recommend potential solutions to mitigate and manage these risks in alignment with the region's short-term and long-term goals. These solutions may include Flood Management Evaluations (FMEs), Flood Management Strategies (FMSs), and Flood Mitigation Projects (FMPs), as defined below:

- Flood Management Evaluation (FME) – a proposed flood study of a specific, flood-prone area that is needed in order to assess flood risk and/or identify potentially feasible FMSs or FMPs,
- Flood Mitigation Project (FMP) – a proposed project, either structural or non-structural, that has non-zero capital costs or other non-recurring cost and that, when implemented, will reduce flood risk, mitigate flood hazards to life or property, and
- Flood Management Strategy (FMS) – a proposed plan that can be implemented quickly to reduce flood risk or mitigate flood hazards to life or property that does not belong in the above categories.

This Technical Memorandum for the Upper Rio Grande RFP is prepared in accordance with the TWDB RFP Scope of Work (SOW) Task 4B, which requires a concise summary of work regarding the following elements of the RFP:

- A list of political subdivisions within the Flood Planning Region (FPR) that have flood-related authorities or responsibilities;
- A list of previous and ongoing flood studies considered by the RFPG to be relevant to development of the Regional Flood Plan;
- A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that the RFPG considers to be best representation of the region-wide 10% annual chance flood event, 1% annual chance flood event, and 0.2% annual chance flood event inundation boundaries, and the

source of flooding for each area, for use in its risk analysis, including indications of locations where such boundaries remain undefined;

- A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that identifies additional flood-prone areas not described in previous bullet based on location of hydrologic features, historic flooding, and/or local knowledge;
- A geodatabase and associated maps in accordance with TWDB Flood Planning guidance documents that identifies areas where existing hydrologic and hydraulic models needed to evaluate FMSs and FMPs are available;
- A list of available flood-related models that the RFPG considers of most value in developing its plan;
- The flood mitigation and floodplain management goals adopted by the RFPG per §361.36;
- The documented process used by the RFPG to identify potentially feasible FMSs and FMPs;
- A list of potential FMEs and potentially feasible FMSs and FMPs identified by the RFPG, if any; and
- A list of FMSs and FMPs that were identified but determined by the RFPG to be infeasible, including the primary reason for it being infeasible;

The Upper Rio Grande RFP Technical Memorandum is arranged by SOW task with each of the items under its associated task. It is intended to comply with the SOW and all applicable rules and statute requirements governing state flood planning under *Title 31* of the *Texas Administrative Code (TAC) Chapters 361 and 362*. In addition, the accompanying geodatabase contains spatial files representing data collected and developed as part of the RFP in accordance with the TWDB Exhibit D Data Submittal Guidelines. Reference tables (Exhibit C A1, A11, A12, A13, and A14, as well as additional Tables B1 and B2) are provided as an attachment with this memorandum for additional information and supporting documentation for the four SOW tasks presented below.

During a public meeting held on January 5, 2026, and in accordance with the *TAC Chapter 31 Section 361.21(h)* notice requirements, AECOM presented a draft version of this Technical Memorandum to the URGRFPG for discussion and comment. URGRFPG voted to authorize AECOM to make non-substantial edits and submit the final Technical Memorandum with non-substantial edits to TWDB. Documentation of this process is provided as an attachment with this memorandum.

Task 1 – Planning Area Description

Task 1 includes a summary of the Region 14 flood planning area as it relates to flood management, flood history, population, economic activity, land use, resources, flood studies, natural flood features, and flood infrastructure.

The planning area for Region 14 follows the Upper Rio Grande in West Texas along the US-Mexico border from the City of El Paso to the Amistad Reservoir in Val Verde County. This region is the largest of the fifteen state flood planning regions by area, covering more than 43,000 square miles across three overall river basins – the Upper Rio Grande, the Pecos River, and the Devils River.

The Upper Rio Grande region represents 23 counties, 30 municipalities (incorporated places), and 31 unincorporated (census-designated) places. In addition to these entities, the region includes three river authorities – the Upper Colorado River Authority, Lower Colorado River Authority, and the Nueces River Authority – as well as other political subdivisions and state or national areas. **Table A1** lists the entities within the FPR that have flood-related authorities or responsibilities.

Where available, the RFP will incorporate information from previous flood studies, including results, models, proposed projects, and cost estimates. To compile this information, AECOM consulted with the RFPG and conducted a detailed survey between August and November 2025. These studies were determined to be relevant to the Regional Flood Plan through review and discussion with the RFPG and can be found in **Table B2.**

Task 2 – Existing and Future Condition Flood Risk Analyses

Task 2 of the Regional Flood Plan includes existing and future condition flood risk analyses. The objective of this analysis is to determine location, magnitude, and frequency of flooding, exposure to identified flooding within the region, and vulnerable communities and critical facilities. These analyses will study the 10%, 1%, and 0.2% annual chance flood events. The primary deliverable will be an updated flood quilt, consolidating various modelling and data sources with the intent of providing a map of the most current understanding of flood risk in the region. This flood quilt will be used in later chapters to identify data gaps and evaluation impacts for potential FMEs, FMPs, and FMSs.

Task 2a Existing Condition

Task 2a of the RFP Scope of Work includes the existing condition flood risk analysis. An existing flood layer will be developed through an evaluation and prioritization of available flood hazard information, both 1D and 2D. This existing flood layer will be used to perform these flood hazard, flood exposure, and vulnerability analyses across Region 14. The starting point for development of the existing flood layer was the Flood Quilt (2024) prepared by and available from TWDB. This comprehensive coverage of existing statewide flood hazard includes multiple data layers from various sources combined into a single flood hazard dataset. Upon clipping the data to the Region 14 extent, the Flood Quilt was confirmed and updated with best available flood hazard data after a detailed review of studies and corresponding modeling performed.

Several flood hazard datasets were evaluated for the 10%, 1%, and 0.2% annual chance events to develop the existing conditions flood hazard area layers for the RFP. These datasets were prioritized and consolidated into a single overall “flood quilt” for the entire region. **Table 1** summarizes the flood hazard datasets evaluated in this study as well as their priority order in the final existing conditions flood quilt. These datasets are also described in further detail later in this memorandum.

The final consolidated existing conditions flood hazard spatial files will be included in a GIS geodatabase format along with the RFP. Existing condition flood hazard areas will be contained in a single feature class (“ExFldHazard”) which includes flood hazard areas for 10%, 1%, and 0.2% annual chance events. In cases of overlapping floodplain sources during consolidation, the flood frequency attribute field (“FLOOD_FREQ”) will be populated using the 1% annual chance event as the highest priority storm event of the overlapping layers.

Table 1: Existing Conditions Flood Hazard Datasets and Priorities

Flood Hazard Data Source	Description	Priority Order (1 – Highest)	
		El Paso County	Outside El Paso County
National Flood Hazard Layer Preliminary Data	Detailed mapping of flood hazards for 1% and 0.2% annual chance events subject to public review and finalization. Published August 8, 2025. 10% flood extents extracted from model documentation. Available in El Paso County only.	1	n/a
Base Level Engineering (BLE) Floodplain	Watershed-scale modeling and mapping using 2D modeling, variable mesh sizing, and terrain breaklines. Available in El Paso County (but mostly superseded by NFHL Preliminary Data) and in select hydrologic unit codes (HUCs) within Region 14.	2 (Fort Bliss only)	1
Local Flood Risk Modeling for Select Communities	Non-regulatory, local flood risk mapping performed during Task 4 of the Upper Rio Grande RFP first cycle for the City of Presidio using HEC-HMS and HEC-RAS 2D. Modeling performed by AECOM in 2023.	n/a	2 (1 in City of Presidio)

Flood Hazard Data Source	Description	Priority Order (1 – Highest)	
		El Paso County	Outside El Paso County
National Flood Hazard Layer Approximate Effective Data	Approximate studies (Flood Zone A) on the effective Flood Insurance Rate Map (FIRM) map. Available in Ector and Val Verde Counties only. Data superseded by BLE floodplains in Ector County and western Val Verde County. Data are used only in eastern Val Verde County.	n/a	3
Cursory Floodplain (Fathom)	Regionwide approximate flood hazard dataset developed using 3-meter resolution fluvial and pluvial models by Fathom	3 (Fort Bliss only, outside BLE data gap)	4
First American Flood Data Services (FAFDS)	Digitized flood hazard information from previously published FIRMs and FISs.	n/a	n/a

National Flood Hazard Layer (NFHL) Preliminary Data

The NFHL is used by FEMA to represent the regulatory floodplains for the National Flood Insurance Program (NFIP). This layer includes flood hazard maps for the 1% and 0.2% annual chance storm events. Floodplain extents for lower intensity storm events, including the 10% annual chance storm event, are also available for extraction of the 10% flood hazard map. When the NFHL is updated, preliminary NFHL datasets are issued for public review and awareness of the proposed change. Preliminary datasets include both detailed and approximate flood study data and typically represent the best available information for their study area.

The FEMA El Paso County Mapping Study was issued as preliminary on August 8, 2025, and is intended to revise the existing FIS for El Paso County. The latest available floodplains from the Preliminary study were used as the top priority floodplain layer for El Paso County in the RFP existing conditions flood quilt.

The Preliminary study was divided into 11 watershed areas, shown in **Figure 1**, with a selection of streams to receive detailed studies. The work areas were initially based on the HUC-12 watersheds surrounding El Paso County and then further refined based on flow paths, drainage areas, consistent land use types, and logical divides between two-dimensional model areas. All portions of the study, with the exception of the Horizon Arroyo (Stream 2), were developed using 2D hydraulic modeling and detailed terrain data to better represent the physical characteristics of the county. As of August 8, 2025, the draft revised preliminary FIRMs were released to address public comments submitted during the appeal period that ran from June to September 2024. Only map changes occurred with this release. No modeling changes have occurred since the previous preliminary release on November 15, 2023. The August 8, 2025 maps were subject to a 30-day public comment period that ended September 8, 2025. The anticipated timeline for the El Paso County preliminary data to become effective is not yet available.

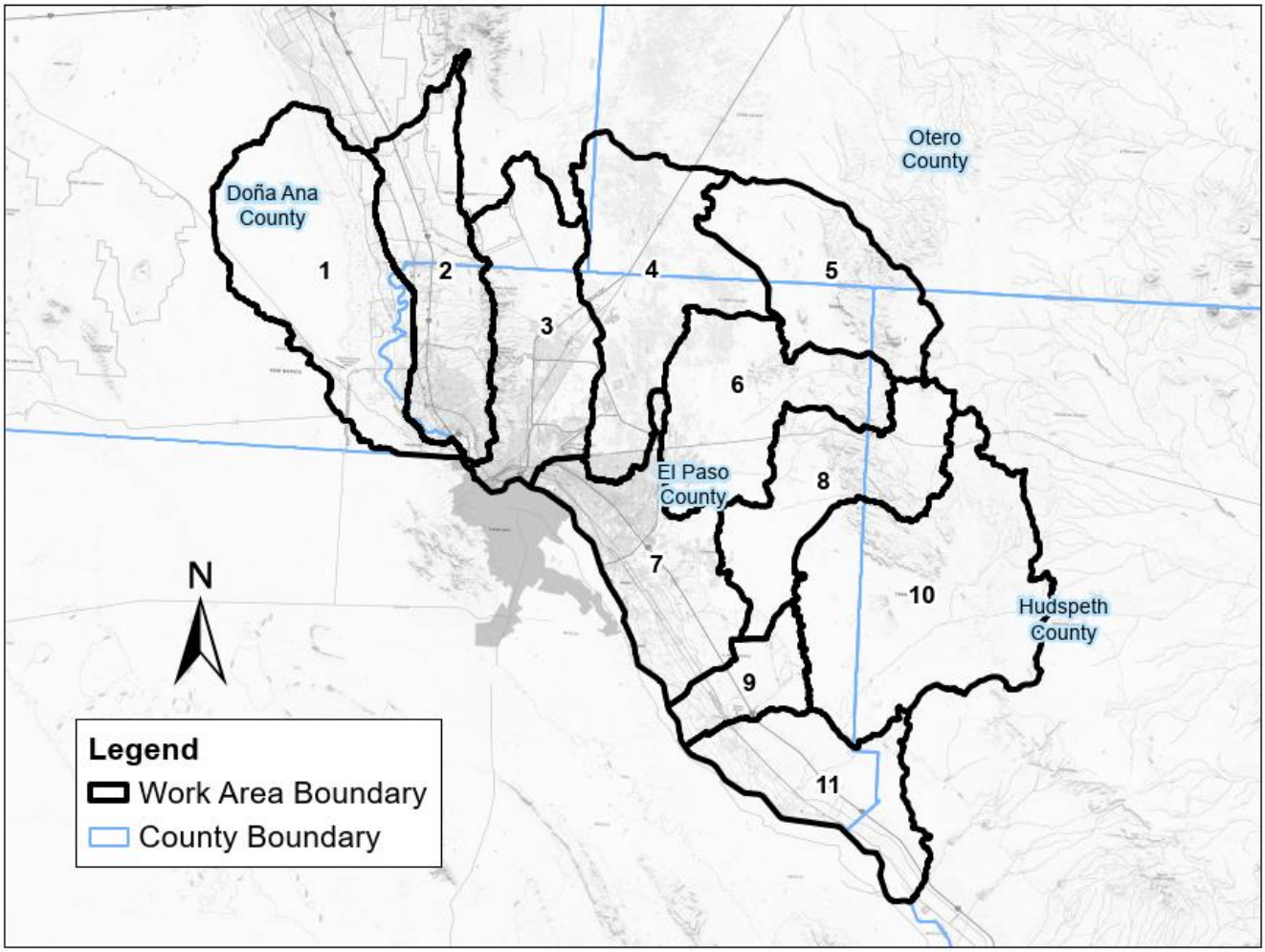

Figure 1 FEMA El Paso County Mapping Study Watershed/Work Area Boundaries

Base Level Engineering (BLE) Floodplain

BLE floodplains are developed using automated methods for watershed-scale modeling and mapping. BLE floodplains were developed for El Paso County completed in 2018 for the FEMA Region IV RiskMAP Program and have since been superseded by the recent 2025 Preliminary FEMA El Paso County Mapping Study. Fort Bliss in El Paso County is one exception to this, as the area is not covered in the 2025 Preliminary Mapping dataset, even though it is covered in the earlier BLE floodplains dataset. The BLE floodplain dataset was used in developing the RFP existing conditions flood quilt for Fort Bliss, minus on small area near the northern El Paso County Boundary which lies outside of BLE HUC 13040100. For this small area in Fort Bliss located outside both the Preliminary Mapping and the BLE datasets, the Cursory Floodplain (Fathom) dataset was used in the existing conditions flood quilt.

Outside of El Paso County, the status of Region 14 BLE data as of August 2025 is provided in **Figure 2**. Published BLE data were not directly available from FEMA's Estimated BFE viewer. Unpublished BLE models and results were obtained for 24 HUCs and the Rio Grande mainstem via data transfer from TWDB and Compass PTS JV, respectively. All unpublished BLE 2D models included the 10%, 1%, and 0.2% annual chance storm events, but the models varied in the level of data extraction and processing needed to arrive at polygons suitable for inclusion in the existing conditions flood quilt. **Figure 2** summarizes the geographic extents of the unpublished BLE models included in Region 14. Where available BLE data were selected as the highest priority in creation of the exiting conditions flood quilt outside El Paso County.

Figure 2 Base Level Engineering (BLE) Data Availability by HUC

Local Flood Risk Data for Select Communities

In the first cycle of the Upper Rio Grande Regional Flood Plan, as part of Task 4 Identification of Flood Mitigation Needs and Solutions, communities were ranked based on the number of buildings at risk in the 1% annual chance event. This information was summarized in “Map 15 Index: Greatest Flood Risk Density of Structures Inundated by 1% AC Flood” in the previous RFP. Three communities were prioritized for further study with detailed modelling – City of Alpine, Town of Pecos City, and City of Presidio. For each community, detailed 2D modelling was performed and recommendations for further studies and projects were provided.
The City of Alpine evaluation revealed a mismatch between modelling and calibration sources. As such, a follow-on study to perform additional modelling and installation of precipitation and stage gages in and upstream of the city was recommended. The modeling for the City of Alpine will be refined following new watershed rainfall and runoff data collection, potentially during the second planning cycle.

The watershed for the Town of Pecos City evaluation extends west encompassing close to 700 square miles The HEC-HMS and HEC-RAS stormwater modeling performed as part of the RFP evaluation assumed a storm over the full watershed, as is the assumption of less detailed models (BLE or Cursory Floodplain [Fathom]), The Town of Pecos City evaluation included local city staff review of modeling results, Local officials had never experienced a flood of the magnitude of the predicted 10% AC flood, much less the 1% AC flood. The modeling for the Town of Pecos City will be refined following new watershed rainfall and runoff data collection, potentially during the second planning cycle.

The City of Presidio has a stormwater master plan with a series of identified potential new flood mitigation projects to alleviate urban flooding associated with local watersheds that drain into the city center. The HEC-HMS and HEC-RAS stormwater modeling performed as part of the Regional Flood Plan evaluation confirmed the need for these projects. The predicted flood extents were in line with city staff experience. These model results, vetted by the local sponsor, are considered to provide a better representation of flood risk than

overlapping BLE or Fathom modeling. The 2D modeling depicting local flood risk for the City of Presidio was incorporated into the second cycle flood quilt. While limited in scope, this focused model provides additional understanding and knowledge when used in conjunction with Cursory Floodplain modeling.

National Flood Hazard Layer (NFHL) Approximate Effective Data

The effective NFHL contains current regulatory floodplains and includes both detailed and approximate flood study data. Two locations in the Upper Rio Grande Region have available NFHL Approximate floodplain data, including Val Verde County (with an effective floodplain date of July 22, 2010) and Ector County (with an effective floodplain date of March 15, 2012). Approximate effective floodplains were superseded by BLE floodplains for Ector County (HUC 13070007) and western Val Verde County (HUCs 13070011, 13070012, 13040210, 13040212). Approximate 1% effective floodplains were used as the top priority floodplains in the RFP existing conditions flood quilt for eastern Val Verde County where BLE data were not available.

Cursory Floodplain (Fathom)

The Cursory Floodplain dataset was originally developed for the TWDB in 2021 and updated in 2025 by Fathom, consisting of both pluvial and fluvial floodplains. Both pluvial and fluvial floodplains were produced using 30-meter resolution models and mapped to a 3-meter resolution for the entire state of Texas. The dataset incorporates NOAA Atlas 14 rainfall in all areas of the state and includes an estimation of flood hazards for the 20%, 10%, 4%, 1%, and 0.2% annual chance events. Improvements in the 2025 dataset include updated terrain based upon newer LiDAR, a refined least squares optimization approach for calculating channel depths, improved coastal boundary conditions based on regionalized storm surge frequency analysis, and the application of spatially varying Manning's roughness for more realistic overland routing of floodwaters.[1]
The Fathom datasets were post-processed by AquaStrategies to remove fluvial and pluvial cells with depths less than 0.5 feet. The Fathom datasets were provided by TWDB to each region in raster format. The datasets associated with the Upper Rio Grande Region were then processed for the RFP in accordance with additional TWDB post-processing specifications. The final post-processed Fathom floodplain layer (Year 2025) was used in union with other available data to fill data gaps for the entire Upper Rio Grande Region outside of El Paso County and for a small section of Fort Bliss inside El Paso County near the northern county border.

While the Fathom dataset is useful at filling flood hazard data gaps, it also has several limitations as indicated in the TWDB Fathom dataset documentation.[2]

Cursory flood data may not appropriately depict flood risk associated with:

  - Constructed features that may alter flow patterns (roadways, railroads, urban areas, storm drainage systems, dams, levees, embankments, etc.)
  - Natural features that may not be fully represented in the 30-meter model (alluvial fans, sinkholes, small tributaries, waterbodies, areas of immediate topographic change, etc.)
  - Border areas along the Texas state boundary

- Cursory flood depths were developed using a high-level statewide assessment and should be used as approximations of flood risk.
- Additional limitations exist for open water bodies, where underwater bathymetry is not known or considered. Additionally, water levels are dynamic, and the variability of the open body water levels is not accounted for in the estimation of flood risk.

[1] Texas Water Development Board (TWDB). July 2025a. Year 2060 Floodplain Maps for Texas – Final Report. Prepared by AECOM, AquaStrategies, and Fathom. Accessed at https://s3.amazonaws.com/twdb-gis-data/Staged/office-of-planning/flood-planning/flood-data/flood-risk/cursory-floodplain-data-2025/Final_Report_YR2060_Flood_Maps_07292025.pdf.
[2] TWDB. Cursory Floodplain Data (2025). Last updated August 19, 2025b. Accessed at https://twdb-flood-planning-resources-twdb.hub.arcgis.com/pages/cursory-floodplain-data-2025.

- Visual artifacts present in the raster data, such as checkerboard or striping patterns, are typically attributed to limitations of the terrain and land use input data. Some of these artifacts were corrected in post-processing steps.
- LiDAR and land use input data sets carry inherent limitations and uncertainties that propagate through to the modeling results.

As a result of these limitations, the Fathom dataset was used as the lowest priority floodplain in the RFP existing conditions flood quilt for all parts of the region. However, in portions of nine counties where BLE floodplains were unavailable (including the Counties of Crockett, Culberson, Edwards, Hudspeth, Jeff Davis, Presidio, Schleicher, Sutton, and Val Verde), the Fathom dataset was used as the primary floodplain dataset.

The first planning cycle Fathom outputs compared to the second planning cycle present-day outputs are broadly similar, with some localized changes, in several parts of the State. These changes are a result of updated model processing and minor differences in input datasets. Where there are changes, the second planning cycle flood extents are expected to be more reliable than the original.

First American Flood Data Services (FAFDS) Floodplain

The FAFDS floodplain layer contains digitized flood hazard information from previously published FIRMs and FISs and is not available for viewing in the NFHL. While FAFDS floodplains are typically older and potentially outdated, they make up a large component of the effective floodplain data in the Upper Rio Grande Region.

Due to the more recent floodplain data available across the Region 14, FAFDS floodplains were used as a reference layer but not formally incorporated in the RFP existing conditions flood quilt. These locations include all or portions of the following 11 counties: Brewster, Crockett, Culberson, Edwards, Hudspeth, Jeff Davis, Midland, Presidio, Sutton, Terrell, and Ward. Effective map dates of these FAFDS floodplains are listed by county for reference in Table 2: FAFDS Effective Map Dates by County.

Nine counties do not have FAFDS floodplains available, including the Counties of Andrews, Schleicher, Pecos, Reagan, Upton, Crane, Loving, Reeves, and Winkler. Floodplains for these latter counties were populated in the RFP existing conditions flood quilt using the BLE dataset (highest priority) or the best available dataset per the **Table 1** prioritization order.

Table 2: FAFDS Effective Map Dates by County

County	FAFDS Effective Map Date
Brewster	10/15/1985
Crockett	4/1/2004
Culberson	11/1/1985
Edwards	2/19/1982
Hudspeth	11/1/1985
Jeff Davis	7/18/1985
Midland	12/6/1999
Presidio	7/3/1985
Sutton	9/1/1987
Terrell	9/1/1987
Ward	10/23/1977-10/25/1977

Existing Flood Hazard Data Gaps

While preliminary flood hazard mapping information is available for El Paso County and approximate flood hazard mapping is available for Ector County and Val Verde County, effective flood hazard datasets across the rest of the region are not available. For the other areas outside of El Paso and east Val Verde counties, as described in the previous section, the existing conditions flood hazard layer utilized a combination of unpublished BLE datasets, local flood risk modeling for the City of Presidio, and the Cursory Floodplain Fathom dataset (with its previously-stated limitations). A summary of the existing conditions flood quilt data availability is provided in **Map 5**. A summary of the existing conditions flood quilt layers by Region 14 county is provided in **Table 3.**

Three types of existing condition flood hazard data gaps were identified across the region based on data availability and reliability. The first type of data gap includes counties which do not have a broad coverage of available FAFDS information or any other available flood hazard data apart from the Fathom dataset. This first group is made up of one county with no FAFDS coverage, Schleicher County.

The second type of data gap includes counties which do have broad coverage of FAFDS information in addition to the Fathom dataset but are in need of updated flood hazard information due to the age of the FAFDS floodplains. This second group is made up of seven counties or portions of counties, including the Counties of Crockett, Culberson, Edwards, Hudspeth, Jeff Davis, Presidio, and Sutton. BLE floodplains for both the first and second type of data gap had a status of “pending upload” per the Texas BLE Status Dashboard.[3]

The third type of data gap includes locations where BLE is the best available flood risk dataset, allowing communities access to quality flood hazard data produced on a watershed scale. BLE assessments produce public datasets that increase transparency and data availability at all levels of government, broaden conversations about flood risk, and inform opportunities for disaster-resilient growth and restoration. BLE datasets, however, are precursors to regulatory FIRM development or updates. BLE modeling uses high resolution ground elevation data combined with approximate modeling methods to create a screening tool for understanding flood risk. BLE models are not regulatory models and are missing the following elements: 1) regulatory floodway analysis, 2) detailed site-specific data (such as structure or cross-section survey), 3) formal FEMA review and adoption process, 4) incorporation of local knowledge and development, 5) accurate backwater effects at confluences, and 6) addressing localized/urban flood risk. This data gap covers the majority of Region 14, as the availability of detailed regulatory models is limited to El Paso County.

[3] TWDB. September 17, 2025. Texas BLE Status Dashboard. Available at https://www.arcgis.com/apps/dashboards/45d3284db7e64694bdcece58c6de39fc.

Table 3: Existing Conditions Flood Quilt Layers by County

County	BLE (Unpublished)	BLE Rio Grande Mainstem (Unpublished)	Cursory Floodplain (Fathom)	Local Flood Risk	NFHL Preliminary Flood Hazard	Zone A	Notes
Andrews	A						
Brewster	A	P					BLE and BLE RGMS union
Crane	A						
Crockett	P		P				Fathom to fill in BLE gap
Culberson	P		P				Fathom to fill in BLE gap
Ector	A						
Edwards			A				
El Paso	P		P		P		Fathom to fill in Fort Bliss gap at north county border
Hudspeth	P	P	P				BLE & BLE RGMS union, Fathom to fill in BLE gap
Jeff Davis	P	P	P				Fathom and BLE RGMS union, Fathom to fill in BLE gap
Loving	A						
Midland	A						
Pecos	A						
Presidio	P	P	P	P			Various union and gap fill
Reagan	A						
Reeves	A						
Schleicher			A				
Sutton			A				
Terrell	A						
Upton	A						
Val Verde	P	P	P			A	Various union and gap fill
Ward	A						
Winkler	A						
Coverage: A = All P = Partial							

Task 2b Future Condition

Task 2b of the RFP Scope of Work includes the future condition. A future flood layer will be used to perform these flood hazard, flood exposure, and vulnerability analyses across Region 14 for the 10%, 1%, and the 0.2% annual chance future condition flood events. While the RFP Technical Guidelines identify different possible approaches for the estimation of future conditions, modifications to the suggested approach were narrowed down to two approaches applied for the region. These approaches included a combination of:

- Utilizing the future conditions Cursory Floodplain (Fathom) dataset for all areas outside of El Paso County, and,
- Updated future condition modeling (performed for the El Paso County watersheds) with considerations for future land use and future precipitation.

Future Flood Risk Identification Outside El Paso County

As presented in the Existing Conditions Methodology, the Cursory Floodplain dataset was originally developed for the TWDB in 2021 and updated in 2025 by Fathom, consisting of both pluvial and fluvial floodplains. Both pluvial and fluvial floodplains were produced using 30-meter resolution models and mapped to a 3-meter resolution for the entire state of Texas. The “Future Conditions” Cursory Floodplain (Year 2060) dataset projects the extent of the future flood hazard areas of Texas in the year 2060 considering four factors: future precipitation changes, sea level rise, future projected land use, and land subsidence along the Texas Gulf Coast.[4]

Four future conditions scenarios were modeled, including three with the same future projected land use and subsidence, under three plausible future climate forcing scenarios (Scenario 1 minimal, Scenario 2 moderate, and Scenario 3 significant). A fourth scenario models a moderate future climate forcing (future precipitation and sea level rise), with present-day land use and no subsidence. Fathom's approach to modeling future hazard is based on the generation of riverine (fluvial) flooding, local (pluvial) flooding and coastal flooding “change factors” from ensembles of global climate models, known as General Circulation Models (GCMs). The change factor grids developed include the 17th, 50th, and 83rd percentile data representing the minor, moderate, and high climate forcing, respectively, from the Fathom study.

A recommendation was made for use of Scenario 3 in regional flood planning: Significant future climate forcing (83rd percentile climate “change factors” applied) with future subsidence and land use change. This scenario represents the upper percentile of possible flood inundation across Texas, allowing robust planning of worst-case flood scenarios.

The Scenario 3 Fathom datasets were post-processed by AquaStrategies to remove fluvial and pluvial cells with depths less than 0.5 feet. The Fathom datasets were provided by TWDB to each region in polygon format for use in developing the future Flood Quilt. A visual check was performed on Scenario 3 by county to verify that the future flood hazard area is at least equal to or greater than the existing flood hazard depicted for the same area. The “Future Conditions” Cursory Floodplain (Year 2060) was applied to all areas in Region 14 outside of El Paso County.

Future Flood Risk Identification for El Paso County

Methodology Selection for El Paso County

Various approaches were considered for developing the future flood layer for El Paso County. These include utilizing the future conditions Cursory Floodplain (Fathom) Scenario 3 dataset, as was employed for all other areas outside El Paso County or utilizing updated future condition modeling with considerations for future land use and future precipitation. Due to the dense population (870,238 in 2024) and corresponding high structure count within the county as well as the availability of a Revised Preliminary FEMA Flood Insurance Study (FIS)

[4] Texas Water Development Board (TWDB). 2025. Cursory Floodplain Data. Accessed at https://twdb-flood-planning-resources-twdb.hub.arcgis.com/pages/cursory-floodplain-data-2025

(2025)[5], a check was performed to ascertain if Future Conditions Fathom Scenario 3 data provided an accurate representation of 2060 flood hazards when compared to the Preliminary FEMA mapping. Note that the Preliminary FEMA mapping is considered the highest priority in the existing condition Upper Rio Grande Flood Quilt and no future conditions modeling or mapping have been performed for the FEMA FIS.

To perform the check, a comparison was made between the two similar existing datasets available for the county, the preliminary FEMA 1% AC floodplain and the Cursory Floodplain Scenario 5 (Existing Conditions). For each of the 11 previously defined watersheds (or "work areas" [WAs]) from the 2019 FEMA hydrology study,[6] the structure count intersecting the FEMA 1% AC floodplain and the Cursory Floodplain Scenario 5 (Existing Conditions) was tabulated, presented in **Table 4**. This structure count tabulation and comparison was performed as a proxy for a future condition comparison if both future datasets had already existed. The rationale is that if the structure count correlation was similar between the two existing datasets, then the correlation should be similar for the future datasets. Thus, if the counts were similar, the Cursory Floodplain Scenario 3 (Future Conditions) could be confidently used as the future flood layer for El Paso County.

Table 4 shows the structure count comparison, with three WAs having a structure count difference of <4% between datasets (WA7, WA8, and WA 10). There is no difference in structure count for WA10 (sparsely populated) versus the 2,462 structure count difference seen in WA7 (densely populated with 106,801 structures). Seven WAs have structure count differences between 4% and 15%, with the largest discrepancy in structure count exhibited in WA3, showing a difference of 8,936 structures at 14.2% difference. Finally, WA1 exhibits a structure count difference of over 50% with the Preliminary FEMA floodplain having 2,193 more structures versus the Cursory Floodplain Scenario 5 (Existing Conditions). In general, the structure counts are generally greater for the Cursory Floodplain dataset, with the main exception being WA1.

Table 4: El Paso County Existing Conditions 1% AC Floodplain Structure Count Comparison: FEMA vs. Fathom

Work Area	Total Number of Structures in Work Area	Number of Structures in Preliminary FEMA	Percentage (%) Structures in Preliminary FEMA	Number of Structures in Cursory Fathom Scenario 5	Percentage (%) Structures in Cursory Fathom Scenario 5	Structure Count Difference Cursory Fathom Scenario 5 and Preliminary FEMA	% Difference in Floodplain Structure Cursory Fathom Scenario 5 and Preliminary FEMA
WA 1	4,040	2,592	64.2%	399	9.9%	-2,193	-54.3%
WA 2	38,566	4,257	11.0%	8,518	22.1%	4,261	11.1%
WA 3	62,825	2,452	3.9%	11,388	18.1%	8,936	14.2%
WA 4	17,677	79	0.4%	796	4.5%	717	4.1%
WA 5	54	4	7.4%	11	20.4%	7	13.0%
WA 6	27,781	403	1.4%	1,700	6.1%	1,297	4.7%
WA 7	106,801	8,397	7.9%	10,859	10.2%	2,462	2.3%
WA 8	2,089	227	10.9%	187	9.0%	-40	-1.9%
WA 9	1,412	289	20.5%	134	9.5%	-155	-11.0%
WA 10	11	4	36.4%	4	36.4%	0	0.0%
WA 11	2,089	267	12.8%	111	5.3%	-156	-7.5%

[5] Federal Emergency Management Agency (FEMA). August 8, 2025. Revised Preliminary Flood Insurance Study, El Paso County, Texas and Incorporated Areas.
[6] Compass PTS JV. June 2019. Final Results of Hydrology Study El Paso County, TX. Contract #HSFE60-15-D-003, Task Order #HSFE06-16-J-0228.

Possible explanations for these structure count discrepancies include:

1) The Cursory Floodplain modeling method (30 meter resolution mapped to a 3-meter resolution, rainfall application, etc.) has known limitations previously presented in the Task 2a Existing Conditions Methodology Memorandum. This dataset is ranked as a lower priority than FEMA detailed modeling, where available, and has a coarser result.

2) Cursory Floodplain data selected for use in Region 14 are a combination of both pluvial and fluvial analyses filtered to a depth of 0.5 feet, whereas the FEMA floodplain filters out data less than 1 foot of flooding depth. It would be expected therefore that the Cursory Floodplain depicts more shallow flooding than the FEMA floodplain data and captures more structures due to these differences in filtering criteria.

3) The WA1 structure discrepancy with the Preliminary FEMA dataset having a greater structure count is due to the incorporation of the FEMA Rio Grande Natural Valley[6] analysis along the Rio Grande River. This Natural Valley analysis accounts for non-certified levee segments (per Chapter 44 Code of Federal Regulations [CFR], Section 65.10) along the river and the resulting flooding that could occur if these levee segments were not physically present. In reality, these levee segments are present in the modeling terrain and are providing flood protection in the Cursory Floodplain data. Therefore, the FEMA data is depicting more structures at risk in WA1 due to the regulation driven absence of existing Rio Grande River levees.

As a result of this structure count comparison for the existing condition floodplains, it was thought that differences of thousands of structures in the most densely populated areas of the county and City of El Paso were too significant to globally apply the “Future Conditions” Cursory Floodplain (Year 2060) to El Paso County. Since recent FEMA hydrologic and hydraulic (H&H) models are available for the county, it was decided that a more consistent representation of the future flood layer could be developed by rerunning the FEMA preliminary models with 2060 future land use and future rainfall. The development of the future land use and future precipitation for El Paso County are described below.

Future Land Use Development for El Paso County

According to population projections from the Draft 2026 Regional Water Plan for TWDB Regions E, F, and J[7], the Upper Rio Grande Region is projected to grow in population between 2030-2060 by approximately 93,000, which is equivalent to a 8% increase over 30 years with an average annual growth rate of 0.27%. Two counties have major population centers located outside the Region 14 watershed boundaries and are excluded from this estimate, including Ector County (City of Odessa) and Midland County (City of Midland). When these population centers are included in the estimate using the projected population estimates from the Draft 2026 Regional Water Plans for TWDB Region F, the projected region population growth rate grows to a 14% total increase over the same period. El Paso County is projected to see the highest future population growth compared to other counties in the region with an increase of approximately 65,000 by 2060. This increase is 30% of the region’s estimated total growth.

To perform the future land use analysis for El Paso County, future population projection data were obtained from the El Paso Metropolitan Planning Organization (MPO) Regional Mobility Strategy (RMS) 2050 Metropolitan Transportation Plan (MTP)[8]. The RMS MTP provides existing (2017) and future (2050) population and employment estimates using more than 800 Traffic Analysis Zones (TAZs) throughout El Paso County[9], each ranging in size from 1 acre (for dense urban areas) to 158 square miles (for dispersed rural areas). Note that future population and employment projections are not available past 2050. Future 2050 estimates were therefore estimated using available data and then scaled up proportionally to year 2060.

[7] Texas Water Development Board (TWDB). March 3, 2025. Draft 2026 Regional Water Plans. Accessed at https://www.twdb.texas.gov/waterplanning/rwp/plans/2026/index.asp
[8] El Paso Metropolitan Planning Organization. March 25, 2022. Regional Mobility Strategy (RMS) 2050 Metropolitan Transportation Plan (MTP). Accessed at https://www.elpasompo.org/departments/mtp/RMS2050MTP.
[9] Alliance Transportation Group. October 2020. El Paso Travel Demand Model Demographic Development. Accessed at https://www.elpasompo.org/media/MTP/RMS2050MTP/FinalMTP_4Nov22/Appendix%20F-TDM%20Demographic%20Development.pdf.

To develop future condition hydrologic models based on these future population projections, a statistical analysis was performed to correlate existing TAZ population densities with land use intensity classes from the National Land Cover Database (NLCD) land cover raster layer. The NLCD land cover layer was selected for this analysis, since a 2011 version of the layer was used in the 2019 FEMA hydrologic study[6] to estimate runoff curve numbers for the hydrologic model. The future condition analysis utilized a similar modified approach by estimating a future condition land cover layer with NLCD classes developed based on future population.

To perform the statistical correlation analysis, the 2016 NLCD Land Cover dataset[10] was used to provide a reasonably close match compared to the existing 2017 population and employment estimates from the RMS MTP dataset. Referencing the 2016 NLCD Land Cover raster, polygons were delineated in GIS to identify representative NLCD class boundaries for “open space”, “low intensity”, “medium intensity”, and “high intensity” categories. Upon delineating these representative zones for the four NLCD class types, the 2017 TAZ population and employment densities were converted to rasters, and zonal histograms were created for each zone based on the gridded TAZ densities. Using this process, correlations were developed between the NLCD intensity class zones and the TAZ densities. Correlations were defined separately for population and employment, identifying lower and upper bounds for each. The results of the correlation analysis are presented in **Table 5**.

Table 5: NLCD and TAZ Correlation Ranges for Population and Employment

NLCD Class	Population		Employment	
	Lower Bound TAZ Density, population per sq. mi.	Upper Bound TAZ Density, population per sq. mi.	Lower Bound TAZ Density, population per sq. mi.	Upper Bound TAZ Density, population per sq. mi.
Open Space	100	1000	10	100
Low Intensity	1,000	3,500	100	300
Medium Intensity	3,500	12,000	300	3,500
High Intensity	12,000	-	3,500	-

These 2016/2017 existing condition correlations were then used to estimate future condition NLCD classes based on the future condition TAZ densities. Future condition NLCD classes were estimated for population and employment separately, and the higher of the two resulting NLCD intensity classes from Table 2 was assigned as the future condition 2050 NLCD class layer. Any voids in the future land use layer (i.e. area not defined by one of the four NLCD intensity classes in **Table 5**) were filled in with 2024 NLCD[11] to create a seamless future land use layer. Lastly, the future condition NLCD class layer was converted to runoff curve numbers using the same methodology discussed in the 2019 FEMA hydrology study. A weighted area analysis was performed using the future condition curve number dataset to estimate future curve number values for each of the 11 previously defined WAs from the 2019 FEMA hydrology study. These estimates are shown as column #3 in **Table 6** below.

In some instances, the estimated future condition 2050 curve number values were found to be lower than the existing condition curve numbers estimated using the 2024 NLCD or the 2019 FEMA hydrology study curve numbers, indicating a lower amount of runoff in future conditions. Therefore, as a conservative measure, a second estimated future condition 2050 dataset was developed by selecting the highest value between the estimated future condition 2050 dataset (column #3 of Table 6), the 2019 FEMA hydrology study (column #2), and the 2024 NLCD Land Cover dataset (column #1).

Table 6 summarizes the final curve number values used for the future condition 2060 analysis (column #5), compared to curve numbers developed using the 2024 NLCD Land Cover dataset (column #1), the 2019 FEMA

[10] Dewitz, J. 2019. National Land Cover Database (NLCD) 2016 Products: U.S. Geological Survey data release, https://doi.org/10.5066/P96HHBIE.
[11] U.S. Geological Survey (USGS). June 2025. 2024, Annual NLCD Collection 1 Science Products (ver. 1.1,): U.S. Geological Survey data release, Accessed at https://doi.org/10.5066/P94UXNTS.

hydrology study (column #2), the estimated future condition 2050 dataset (column #3), and the final estimated future condition 2050 dataset (column #4). The final future condition curve number (column #5) for each work area was used in conjunction with the future precipitation estimates discussed below in estimating the future condition floodplain for El Paso County.

Note that the curve numbers generated for future conditions analysis were developed specifically for use in the Regional Flood Plan and are intended solely for regional planning purposes. These values are designed to support large-scale hydrologic modeling and flood management strategies within a regional context. They are not intended to be used for any type of development or site-specific design applications, as they do not account for localized conditions or detailed project-specific requirements. Any use of these curve numbers outside the scope of the Regional Flood Plan would be inappropriate and could lead to inaccurate or unreliable outcomes.

Table 6: Future Runoff Curve Numbers (CN) for El Paso County

Work Area	Curve Number				
	#1 Existing Condition, NLCD (2024)	#2 Existing Condition, FEMA Hydrology (2019)	#3 Estimated Future Condition (2050)	#4 Estimated Future Condition (2050) Maximum of #1, #2, or #3[a]	#5 Estimated Future Condition (2060)[b]
WA 1	62	62	66	66	68
WA 2	77	77	80	80	82
WA 3	76	78	83	83	86
WA 4	64	65	74	74	77
WA 5	77	77	78	78	78
WA 6	70	69	81	81	85
WA 7	75	73	80	80	81
WA 8	76	75	76	76	76
WA 9	67	66	65	67	67
WA 10	78	79	77	79	79
WA 11	66	67	68	68	69

a. The future condition CN (2050) (#4) was developed by applying the highest value between the Estimated Future Condition (2050) CN layer (#3), the Existing Condition, FEMA Hydrology (2019) CN layer (#2), and the Existing Condition, NLCD (2024) CN layer (#1).
b. The future condition CN (2060) (#5) was estimated based on CN increase realized between #1 and #4 applied to the ten-year period between 2050 and 2060.

Future Precipitation for El Paso County

Future precipitation trends are influenced by changes in climate. Future climate projections for the Southwest and Southern Great Plains have primarily projected decreases to total annual precipitation. On the other hand, future increases in atmospheric temperatures have also been projected to increase the magnitude of extreme precipitation events throughout the U.S, as a result of increased atmospheric moisture carrying capacity. “Water vapor factors into the intensity of precipitation extremes, such that increased water vapor due to warmer air temperatures alone would drive relatively uniform projected increases in precipitation extremes over much of the planet.”[12]

[12] U.S. Global Change Research Program (USGCRP). 2023. Fifth National Climate Assessment. Washington, DC, USA. Accessed at https://repository.library.noaa.gov/view/noaa/61592/noaa_61592_DS1.pdf?download-document-submit=Download

Two estimates of future precipitation (2060) were developed for consideration for application over El Paso County. The estimates include 1) Fathom year 2060 1 percent (%) AEP exceedance probability (AEP) 24-hour duration rainfall and 2) 2019 FEMA hydrology study 1% AEP 24-hour duration rainfall scaled up with a uniform percent change.

Fathom 2060 Rainfall. The 83rd percentile ("high climate forcing") 2060 1% AEP 24-hour duration Fathom precipitation data used in the TWDB Cursory Floodplain data[4] were downloaded and compared to precipitation data from the El Paso County 2019 FEMA hydrologic models. The Fathom precipitation data has a cell size of 30 meters and is based on "a 2°C global mean temperature increase relative to the estimated temperature of the 1850-1900 pre-industrial period…".[13] The 2019 FEMA hydrologic models used precipitation data from the 2008 El Paso Drainage Design Manual for watersheds within the City of El Paso (where the Drainage Design Manual took precedence). Elsewhere within El Paso County the FEMA models used NOAA Atlas 14 precipitation data. The combined dataset was spatially averaged based on the FEMA WAs. The comparison of 1% AEP 24-hour duration rainfall between the FEMA existing study and Fathom 2060 estimate for all eleven WAs is provided in **Table 7.** This comparison indicates that the Fathom 2060 estimated 1% AEP, 24-hour duration rainfall increase compared to the FEMA study is generally less than 4%, except for WA2 and WA3 which have increases of 7% and 24%, respectively.

Table 7: 1% AEP 24-hour Duration Rainfall Comparison Based on FEMA Work Area Watershed Boundaries

Work Area	FEMA 2019	Fathom 2060	% Change
	1% AEP (in.)	1% AEP (in.)	
WA1	3.79	3.81	1%
WA2	3.98	4.26	7%
WA3	3.57	4.42	24%
WA4	4.14	4.25	3%
WA5	4.56	4.54	0%
WA6	4.60	4.74	3%
WA7	4.36	4.49	3%
WA8	4.85	4.90	1%
WA9	4.40	4.45	1%
WA10	4.93	4.99	1%
WA11	4.39	4.44	1%

Uniform Percentage Increase. The Office of the Texas State Climatologist issued recommendations in April 2021 on accounting for future precipitation in Regional Flood Planning.[14] The analysis showed moderate trends of increasing rainfall near El Paso County based on trends in 1% AEP values of 24-hour precipitation amounts in NOAA Atlas 14 data. However, for the majority of the Upper Rio Grande region, results were inconclusive regarding future precipitation trends.

[13] Texas Water Development Board (TWDB). July 2025. Year 2060 Floodplain Maps for Texas – Final Report. Prepared by AECOM, AquaStrategies, and Fathom. Accessed at https://s3.amazonaws.com/twdb-gis-data/Staged/office-of-planning/flood-planning/flood-data/flood-risk/cursory-floodplain-data-2025/Final_Report_YR2060_Flood_Maps_07292025.pdf.
[14] Nielsen-Gammon, J., S. Jorgensen, 2021: Climate Change Recommendations for Regional Flood Planning. Department of Atmospheric Sciences, Texas A&M University. Accessed at https://climatexas.tamu.edu/files/CliChFlood.pdf

The 2024 climate report titled “Assessment of Historic and Future Trends of Extreme Weather in Texas, 1900 to 2036”, published by the Office of the Texas State Climatologist, indicates that a statewide average increase of 20% in extreme precipitation is expected for year 2036 compared to the 1950-1999 time period.[15]

In a contracted effort with Texas A&M University and Rice University, TWDB has an ongoing project titled “Developing Future Rainfall Frequency Grids for the State of Texas” and has released a Texas Floodplain Management Association (TFMA) August 2024 Technical Conference Presentation with a graph of preliminary results for El Paso (final results are not available yet).[16] Based on the graph shown in **Figure 1**, the projected increase from approximately 2022 to 2060 in the 1% AEP 24-hour duration rainfall is about 24% for Representative Concentration Pathway (RCP) 6. The increase is based on approximate length measurements taken from presentation graph. Scaled to the years 2025 to 2060, the projected one-day rainfall increase would be approximately 22%.

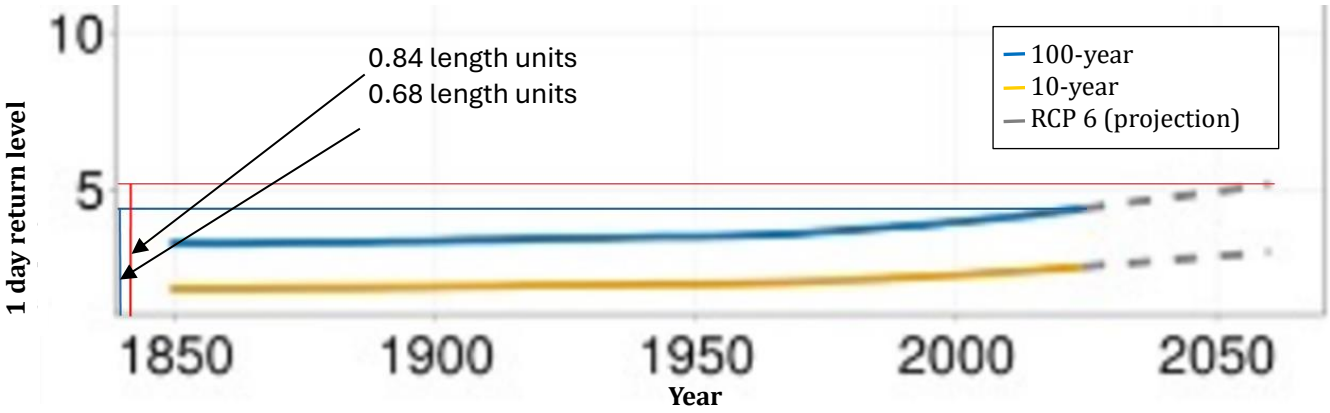

Figure 1 Projected Increase in the 1% AEP 24-hour Duration Rainfall for El Paso, TX

While increased rainfall is likely to result in increased runoff in urban areas where land cover is impervious, the Rio Grande and other rivers (which are primarily controlled by upstream dams) are less likely to see significantly increased flows during extreme precipitation events due to the influence of upstream controlling reservoirs. Based on these findings, the future condition analysis for El Paso County was modified to include an increase in precipitation of 20% based on recommendations from the 2021 Texas State Climatologist report. This amount corresponds to the report’s high change scenario for urban watersheds in the 2050-2060 time horizon and is in general alignment with the increase estimated by the preliminary data from the “Developing Future Rainfall Frequency Grids for the State of Texas” project.

Because datasets are incomplete for all standard future rainfall conditions durations, the shape of the future condition hyetographs will be based on the shape of the hyetographs from the 2019 FEMA hydrologic models. These models used nested hyetographs based on the Frequency Storm distribution method within HEC-HMS with spatially averaged rainfall data for each duration.

Future Flood Hazard Areas for El Paso County

Future conditions flood risks were estimated for El Paso County by modifying the input parameters in available FEMA hydrologic and hydraulic models to account for future trends in land use and precipitation presented above. Note that the 2025 Preliminary FEMA floodplains[5] current to this study were developed from the 2019 FEMA hydrologic study discussed above and corresponding 2D hydraulic models. The hydrologic (HEC-HMS) and hydraulic (HEC-RAS) models for each of the 2025 Preliminary FEMA floodplain WAs were obtained and

[15] Nielsen-Gammon, J., Holman, S., Buley, A., Jorgensen, S., Escobedo, J., Ott, C., Dedrick, J., & Van Fleet, A. 2024. Future Trends of Extreme Weather in Texas (2024 update). Texas 2036. Accessed at https://texas2036.org/wp-content/uploads/2023/06/2024_ClimateReport.pdf
[16] Nielsen-Gammon, J., Niraula, R., Doss-Gollin, J., Nuccitelli, S., & Escobedo, J. 2024. Developing Future Rainfall Frequency Grids for the State of Texas. Texas Water Development Board. Accessed at https://cdn.ymaws.com/www.tfma.org/resource/resmgr/2024_technical_summit/presentations/track_e/e3_developing_future_rainfal.pdf

updated based on the findings from the previously described evaluations of future land use and future precipitation.

Updates to the hydrologic and hydraulic models included replacing the existing condition curve number inputs with 2060 future condition curve number inputs (to estimate future land use) and scaling the input rainfall by 20% (to estimate future precipitation increases).

After extracting the existing condition rainfall and scaling up by 20% for all work areas, the updated precipitation hyetographs were applied as inputs in the 2D hydraulic models. To account for interdependent work areas that share outflow and inflow boundary conditions, outflow hydrographs from upstream work areas were extracted and input at the appropriate location in the downstream model.

Based on the results of the future condition 2D hydraulic analyses, future condition floodplains were mapped for all 11 work areas, covering El Paso County and the west part of Hudspeth County (corresponding to the HUC-8 watersheds 13040100 and 13030102). Whereas the FEMA study did not include the area inside Fort Bliss, the area was included along with the rest of El Paso County in the future conditions results.

Future floodplain polygons for El Paso County were post-processed using 2D BLE Tools from a proprietary AECOM hydraulics tool set. The tool delineates 10%, 1%, and 0.2% flood hazard areas using stream centerlines and HEC-RAS outputs including water surface elevation and depth rasters. Floodplain polygons were delineated based on areas which have a flow depth of at least 0.5 foot (consistent with the 2025 Preliminary FEMA floodplain development) and intersect the streamlines. Small areas of isolated flooding disconnected from the stream centerline were removed during this process.

Finally, the future condition flood hazard areas were merged with the existing condition flood hazard areas, retaining areas of furthest extent between the two, ensuring that the future conditions flood risk is equal to or greater than the existing condition flood risk. This process also ensured that all flood hazard areas from the FEMA study were excluded in the future conditions floodplain, since portions of the study were not delineated based on the 2D hydraulic WA models but were instead delineated based on the results of other studies such as the Rio Grande Natural Valley Study.

Table 8 below lists flood-related models most relevant to the Upper Rio Grande RFP.

Table 8: Relevant Flood-Related Models

#	Location	Modeling Software	Source
1	El Paso County, within the Rio Grande Natural Valley Floodplain	FLO-2D, HEC-HMS, and HEC-RAS 2D	El Paso County Interior Drainage Study (El Paso Water and El Paso County, 2021)
2	El Paso County	HEC-HMS and HEC-RAS 2D	Preliminary FEMA El Paso County Mapping Study (FEMA, 2019) *(Note: as of November 2021, preliminary models are being adjusted to address appeals submitted during the appeal process – no current timeline is available for completion)*
3	Rio Grande – through Doña Aña County, NM and El Paso County, TX to Fort Quitman in Hudspeth County, TX	FLO-2D	El Paso County Natural Valley Analysis Pre-LAMP Report (FEMA RiskMAP, October 2016)
4	City of El Paso	HEC-HMS and HEC-RAS 1D	City of El Paso Stormwater Master Plan (EPWU, 2009)
5	El Paso County	HEC-HMS, HEC-RAS 1D, and CulvertMaster	El Paso County Stormwater Master Plans (El Paso County, 2010 and 2021)

#	Location	Modeling Software	Source
6	Rio Grande from Anthony, New Mexico to American Dam in El Paso	HEC-RAS 1D	"Evaluation of Reduced Flow Capacity of the Rio Grande" Phase 1 report (Joint Committee on Rio Grande Project Flood Risk, 2019)
7	Rio Grande from just upstream of American Dam in El Paso to Little Box Canyon, in Hudspeth County, TX	HEC-RAS 1D, not georeferenced	USIBWC (2003)
8	Texas, statewide	Fathom 2D models	TWDB/Fathom (October 2021)
9	Canalization Reach of the Rio Grande, from Percha Diversion Dam to American Dam in El Paso	HEC-HMS and HEC-RAS	USIBWC *(expected to be available August 2022)*
10	Americas Ten Dam in El Paso	HEC-HMS and HEC-RAS 2D	Decommissioning Americas Ten Dam because of maintenance access issues (El Paso Water, 2010)
11	City of El Paso High Hazard Dams	HEC-HMS	Probable Maximum Precipitation Update (El Paso Water, 2018)
12	City of El Paso High Hazard Dams	HEC-HMS, FLO-2D, SITES	Emergency Action Plan for City of El Paso High Hazard Dams (COEP and EPWU, 2010)
13	SH 20 (Mesa Street) From Doniphan Drive to Texas Avenue	HEC-HMS, EPA SWMM	Drainage Study for SH 20 (Mesa Street) From Doniphan Drive to Texas Avenue (TXDOT, 2019)
14	FM 170 (Mesa Street) From Candelaria to US-67	HEC-HMS, HEC-RAS 1D	Drainage Study for FM 170 From Candelaria to US-67 (TXDOT, 2020)
15	Rio Grande Interior Drainage, from International Dam to Riverside Weir	HEC-HMS, StormCAD, FLO-2D, CulvertMaster, FlowMaster	Interior Drainage H&H Analysis for El Paso, TX International Dam to Riverside Weir (EPWU and USIBWC, 2016)

Task 3 – Floodplain Management Practices, Mitigation Needs Analysis, & Goals

Task 3 includes an evaluation of the role of floodplain management and land use practices on existing and future flood risk throughout the Upper Rio Grande region. Through this task, the RFP will address the following key SOW items outlined by TWDB:

- "Recommend forward-looking floodplain management and land use recommendations, and economic development practices and strategies, that should be implemented by entities within the FPR" (Task 3A, §361.35), and
- "Identify specific and achievable flood mitigation and floodplain management goals along with target years by which to meet those goals for the FPR" (Task 3B, §361.36).

The recommendations and goals for RFPG adoption described in this memorandum were developed based on input received from the RFPG during meetings as well as input from other regional stakeholders provided through the stakeholder survey process.

The intent of Task 3 is to review the previous Tasks 1 and 2 and to provide recommendations, needs, and goals generally applicable to the planning region. Task 3a is intended to recommend broadly applicable forward-looking practices for communities to implement or work towards to advance flood mitigation and floodplain management. Task 3b identifies areas without sufficient studies, projects, documentations, or understanding to implement floodplain mitigation efforts. Task 3c recommends a list of goals from the RFPG to organize and prioritize efforts in the region. Efforts not aligning with task 3c goals, while potentially effective, are understood not to support the wider goals of the region or to conflict with the desires of the community they would serve.

Task 3A – Region 14 Floodplain Management and Land Use Recommendations

The following region-specific floodplain management and land use recommendations should be implemented by entities within the FPR and are categorized as either *recommendations for minimum standards* or *general recommendations*:

- *Recommendations for minimum standards* include minimum floodplain management standards required for communities to participate in the National Flood Insurance Program (NFIP). In future Planning Cycles, these minimum standards recommendations may be adopted as minimum requirements by the RFPG which entities must meet to include flood needs (FMEs, FMSs, FMPs) in the Regional Flood Plan.
- *General recommendations* include all other region-specific recommendations which entities should implement apart from the NFIP minimum standards. While these general recommendations are strongly encouraged, the RFPG does not anticipate adopting them as minimum standards in future planning cycles.

The RFPG presents the following region-specific *recommendations for minimum standards*:

- Participate (and maintain active status) in the National Flood Insurance Program (NFIP)
- Require development permits for all proposed construction to determine whether such construction is proposed within flood-prone areas and will be reasonably safe from flooding (44 CFR § 60.3a[1-4])
- Require new and replacement sanitary sewage and water supply systems within flood prone areas to be designed to minimize or eliminate infiltration of flood waters into the systems (44 CFR § 60.3a[1-5])
- Require additional minimum standards for flood-prone areas associated with designated special flood hazard areas (Zone A and AE) (44 CFR § 60.3b-d)
- Require additional minimum standards associated with mudslide (i.e. mudflow)-prone areas (44 CFR § 60.4)

- Require additional minimum standards associated with flood-related erosion-prone areas (44 CFR § 60.5)

In addition to the *recommendations for minimum standards*, the RFPG presents the following region-specific *general recommendations*:

- Establish local flood outreach and awareness programs (addressing flood risk, resiliency, and mitigation), including providing access to FEMA informational resources
- Coordinate with TxDOT and NWS to use flood warning signs, traffic message boards, and other media (TV, radio, social media) to communicate flood warnings
- Conduct public outreach to identify ongoing flood needs (data gaps, flood management strategies, and flood mitigation projects)
- Develop and maintain local stormwater asset management plans
- Develop and adopt a FEMA-approved Hazard Mitigation Plan (HMP) (affects FEMA Hazard Mitigation Assistance Program grant eligibility)
- Adopt higher-than-NFIP-minimum standards (e.g., higher freeboard) and participate in the TFMA Higher Standards Survey
- Enroll in CRS Program for reduction in flood insurance premiums and flood risk
- Consider and incorporate nature-based practices in flood mitigation projects where possible

Task 3B – Flood Mitigation Needs Analysis

Flood Prone Areas. Based on the identified existing conditions flood hazard areas, an existing flood exposure analysis is in progress to identify who or what might be harmed within the region for the 1% and 0.2% annual chance flood events. The exposure analysis evaluates potential flood impacts to population, property, critical facilities, public infrastructure, roadways, and agricultural resources. Areas of greatest flood risk were identified at the county level by ranking each county based on the results of the existing conditions 1% AC flood exposure analysis from Task 2. In the county analysis, counties with the greatest flood risks were identified if they ranked among the top 6 (roughly equivalent to the top 25%) of all counties in the region for any of the flood exposure categories. The results of this county ranking analysis are presented in **Table 9** for population and property only for the top ten counties in descending order.

The RFPG has identified counties with the most critical flood mitigation and flood risk study needs resulting from the Region 14 existing condition flood risk analysis. The counties most prone to flooding threating life and property in descending order from the 1% and 0.2% AC events include El Paso, Reeves, Pecos, Ward, Winkler, and Brewster Counties. Note that Pecos and Ward Counties switch ranking order for number for structures impacted. These counties have a flooded structure count ranging from 1,926 up to 20,185 and a corresponding impacted population ranging from 5,527 up to approximately 125,000.

Table 9: Greatest Flood Risk by County

County Rank	County	Number of Structures in 1% AC Floodplain	County	Population in 1% AC Floodplain
1	El Paso	20,185	El Paso	124,973
2	Reeves	6,383	Reeves	20,168
3	Ward	4,306	Pecos	13,846
4	Pecos	4,091	Ward	12,529
5	Winkler	2,382	Winkler	6,503

County Rank	County	Number of Structures in 1% AC Floodplain	County	Population in 1% AC Floodplain
6	Brewster	1,926	Brewster	5,527
7	Upton	1,277	Upton	3,649
8	Crockett	1,235	Crane	3,303
9	Crane	1,225	Presidio	1,924
10	Presidio	1,012	Sutton	1,675

Legend:

Greatest Flood Risk

The City of El Paso is the most populous community within El Paso County and Region 14. El Paso County is uniquely impacted by flooding due to the regional Monsoon season weather pattern, the Franklin Mountains, and the resulting high intensity storm events, high velocity debris flow, and its location adjacent to the Rio Grande River with select non-certified levee or non-constructed levee segments. The number of structures flooded and the impacted population in El Paso County is equal to or exceeds all other Region 14 counties combined. Other affected communities in El Paso County include Canutillo, Clint, Homestead Meadows North, and Prado Verdo Reeves County and adjacent Pecos County are both rural, each with a county seat that is prone to structure flooding and has significant population at risk, City of Pecos and City of Fort Stockon, respectively. Lindsay, Toyah, and Balmorhea to the southwest of City of Pecos and Imperial to the north of Fort Stockton are also prone to flooding. Revees County also has limited agricultural use and oil and gas well pads. The well pads, while not near population centers, can increase runoff due to the cleared vegetation and exposed soil that accompanies each well pad installation.

The county seat of Ward County, City of Monahans, and adjacent Thortonville and Southwest Sandhill, as well as Barstown in the southwest part of the county are also prone to flooding threating life and property. The county seat of Winkler County, Kermit, is also prone to flooding impacts. Both Ward and Winkler County also have high concentrations of oil and gas well pads throughout each county. Brewster County, known for Big Bend National Park, has critical flood risk study needs due to flooding in Alpine.

Inundation Mapping and Hydrologic and Hydraulic Modeling. The RFPG has identified flood-prone communities lacking hydrologic and/or hydraulic modeling and corresponding inundation maps through the identification of FMEs discussed in Task 4. Without these modeling and data, it is difficult to refine exposure and assess flood mitigation needs. Noted flood-prone communities at this time include City of Pecos in Reeves County, Fort Stockton and Iraan City in Pecos County, Monahans in Ward County, and Kermit City in Winkler County, and Alpine in Brewster County. Note that Alpine will use data from proposed rain and stream gages to refine existing H&H modeling and the resulting inundation map.

Emergency Need. The classification of a proposed action as an “Emergency Need” is reserved for actions related to the following:

- Emergency Response activities, such as early warning systems; or
- Flood control infrastructure protecting a populated area has been identified as inadequate by authorities responsible for inspecting and regulating stormwater infrastructure, such as Texas Commission of Environmental Quality (TCEQ) Dam Safety.

Marfa in Presidio County is identified as having an emergency need for an early warning system due to a June 27-28, 2021, fatality from a vehicle swept away at a low water crossing. This early warning system would consist of installing a flood gage upstream of Marfa and adding flood gates to roadways at four low water crossings (LWCs) (FMP ID: 143000007). The location where a driver was swept away in his vehicle was at the LWC of Alamito Creek near the intersection of Neville Street and Dallas Street. The other three proposed locations for

automatic road closure gates are also for Alamito Creek LWCs near the intersections of Waco Street and Dean Street, Dallas Street and Spring Street, and Lincoln Street and A Street.

No other flood-related fatalities have occurred in the Region since 2021, but region-wide other low water crossings, areas frequently impacted by localized flooding, and transient populations vulnerable to flash flooding (e.g. campgrounds) are considered to have significant flood risk and emergency need for flood mitigation activities. Transient populations are especially vulnerable, as they are not in permanent structures, can more easily be impacted and/or swept away by flash flooding, and are also not accounted for in FEMA or TWDB populations estimates used to quantify risk. The Brewster County Emergency Management Coordinator (EMC) has noted this concern for campgrounds area, including Big Bend National Park. A region-wide planning approach to select the optimum locations for new flood gages, early warning systems, and road closure is reflected in Region 14's draft goals (**Table A11** Flood Mitigation and Floodplain Management Goals).

Another vulnerable population group is the underrepresented colonias population present along the Texas-Mexico border. These are unincorporated, unplanned, often low-income communities, characterized by inadequate infrastructure like utilities and safe housing (i.e. slabs poured at grade). These rustic communities often have no historic knowledge of flooding issues due to sparse population and their tendency to appear suddenly. The structures are likely not flood resistant, not insured, and there are no early warning systems for these communities. Colonias are also only partially represented in the Texas Flood Social Vulnerability Index (SVI) data, as these data are attached to individual structures, with the most recent structure dataset dated 2021.

There are approximately 27 dams, (approximately 25% of the dams in the Region 14) that are identified by TCEQ as hydraulically inadequate. As is the case with many dams throughout Texas, significant development has occurred downstream of some dams while other dams are already located upstream of populated areas. There are also state-regulated dams in the region with unknown hydraulic adequacy status. These dams need a variety of actions, including Emergency Action Plan (EAP) development as an initial step to protect populations downstream, initial dam adequacy studies, watershed planning, and finally rehabilitation design and construction.

Task 3C – Flood Mitigation and Floodplain Management Goals

The Flood Plan Task 3C Scope of Work requires the RFPG to adopt both Short-Term (10-year) and Long-Term (30-year) flood mitigation and floodplain management goals. These goals help to establish the RFPG's objectives and priorities for the FMEs, FMPs, and FMSs included in the flood plan. With input from the Upper Rio Grande RFPG , 31 individual goals have been proposed with the following objectives:

- Adoption of floodplain management practices to reduce flood risk (362.3.b.6)
- Early Warning
- Public Information and Outreach
- Flood Hazard Modelling Improvements
- Flood Exposure Reduction
- Flood Vulnerability Reduction
- Nature-Based Solution Adoption
- Dual-Use Stormwater/Water Supply Benefits

For each of these goals, a goal term (short-term or long-term), target year (2033 for short-term goals or 2053 for long-term goals), goal application area (region-wide or specific HUC-8 watersheds), and method of measuring future progress against the goal. Additionally, AECOM is in the process of identifying residual risk, associated goal identification numbers, and consistency with overarching goals from the Guiding Principles outlined in TAC

Chapter 362. A list of the 31 Short-Term and Long-Term goals is presented in **Table A11** and will be approved by the Upper Rio Grande RFPG prior to submittal of the draft Regional Flood Plan.

The proposed additions and revisions in this cycle are intended to better identify and quantify the target communities and HUCs. The intended outcome is to better focus FMEs toward the at-risk communities and HUC8s. The proposed new goals prioritize planning through Storm Water Master Planning for communities, Emergency Action Planning for dams, and additional participation in the Regional Flood Planning process.

Task 4 – Identification and Evaluation of FMEs, FMSs, FMPs

All Flood Mitigation Projects (FMPs) and Flood Management Strategies (FMSs) that are identified as potentially feasible flood reduction projects will require the use of detailed hydrologic and hydraulic models to quantify flood risk reductions to structures and populations, including residential properties, agricultural land, and critical facilities. Furthermore, FMSs and FMPs must be evaluated to adhere to General Mapping and Modeling Guidelines (defined in Section 3.5 of the Technical Guidelines) and ensure that no negative impacts are received by neighboring areas.

Any FMSs or FMPs which are identified to be potentially feasible through the processes described in this section of the Memorandum will be further evaluated as part of Task 4A to determine whether they have sufficient H&H modeling data to be analyzed for project impacts and benefits. The FMP flow chart from Section 2.4A of the Technical Guidelines will be implemented as part of this screening process. If best available H&H models are deemed insufficient for quantifying project benefits and impacts, or if negative impacts are estimated for neighboring areas, those potentially feasible FMSs and FMPs will be categorized instead as potential FMEs. The general scope items associated with those FMEs would include:

- Development of detailed H&H models,
- Evaluating alternatives to define flood mitigation projects resulting in no negative impacts,
- Quantifying project impacts and benefits, and
- Estimating project costs.

The process described in the following sections would then be re-applied to the potentially feasible FMSs and FMPs to be considered for recommendation in the RFP cycle.

Status of Detailed H&H Models in the Planning Region

All, or portions of, the following 23 Texas counties are represented in the Upper Rio Grande Region: Brewster, Crane, Culberson, El Paso, Hudspeth, Jeff Davis, Loving, Pecos, Presidio, Reeves, Terrell, Ward, Andrews, Crockett, Ector, Edwards, Midland, Reagan, Schleicher, Sutton, Upton, Val Verde, and Winkler. Most of the region has relatively older regulatory FEMA floodplain mapping compared to the rest of the state, and 4 counties (Andrew, Winkler, Reeves, and Pecos) do not have regulatory FEMA floodplain maps or models.

At this point in time, El Paso County is the only County in Region 14 identified to have detailed H&H models, which could potentially be used to quantify project impacts and benefits for a prioritized list of projects documented in local Stormwater Master Plans (SWMPs). However, even within El Paso, certain types of FMSs or FMPs may not have sufficiently defined project parameters or detailed hydraulic models necessary to be fully evaluated and recommended in this first cycle of the RFP.

Process for Identification of Potential FMEs and Potentially Feasible FMSs

The process for identification and evaluation of potential FMEs and potentially feasible FMSs was performed with the following activities that were identified as part of the first Regional Flood Plan Cycle and some of them updated during this second Regional Flood Plan Cycle.

‣ Identification via Review of Historic Events

The recommended process for identification of potential FMEs and potentially feasible FMSs includes these steps:

- Selection of recent historic storms that would serve as the basis for identification of needs. Relation of experiences to problems encountered by flood management agencies and the public are a means to ensure identification of major issues. Additionally, sharing anecdotal experiences will foster a broader appreciation across the RFPG for the overarching issues that could be addressed by an FME or FMS.

- The RFPG conducted approximately ten one-on-one communications with cities and counties to share updates on the Region 14 Upper Rio Grande's adopted amended regional flood plan and to present the course of action for Cycle 2, detailing how FMEs, FMPs, and FMSs will be implemented. Additionally, three roadshows were held—one in Alpine, one in Fort Stockton, and one in El Paso—to maximize community attendance due to their geographic proximity to the respective showcases. At these events, stakeholders shared their experiences regarding flood-related challenges. During public discussions, brief descriptions of each problem were developed to clearly define community needs, accompanied by proposals for FMEs and FMSs to address those needs. Furthermore, public surveys were conducted in both English and Spanish targeting public officers and the general public, as part of the comprehensive public involvement effort.

‣ *Selection of recent historic storms.*

Storms are identified either by stakeholders or the public during the General RFPG Meetings, or via the public survey process. Storms that have been identified to date include:

- August 2006 storm. This multi-day storm centered over west and northwest El Paso County dropped large volumes of rain, leading to overtopping of Interstate (IH)-10, and sediment/debris flows from Franklin Mountain arroyos into the city drainage infrastructure in west/ northwest El Paso and in northeast El Paso. The resulting blockage of drainage infrastructure led to extensive property damage. The high stage in the Rio Grande coupled with limited drainage structure/ pump station capacity led to extensive flood damage in several locations within the flat riverine terrace adjacent to the Rio Grande.

- August 2021 storm. This short, intense, extreme storm overwhelmed drainage infrastructure in east central El Paso. Several small flood control structures had major releases from emergency spillways, IH-10 was overtopped, and numerous neighborhoods and streets experienced short term flooding.

- September-October 2008 storm. This storm, centered over the Rio Conchos watershed in Mexico, sent a massive flood down the Rio Conchos into the Rio Grande. Flooding occurred along the Rio Grande from the confluence with the Rio Conchos to Amistad Reservoir. This flood breached and/or overtopped both US and Mexican levees at locations along the Rio Conchos and the Rio Grande. Flooding in Presidio itself was averted by the levee in the immediate area of the city. This portion of the Rio Grande levee did not overtop and held back the flood.

- July 2025 storm. This short, intense, extreme storm caused significant flooding in Alpine, particularly along Alpine Creek and Paisano Creek. The intersection underpass at US 67/90 (RM 908-910) became impassable due to high water levels. As a result, the TxDOT crew on site had to divert traffic through a side road.

‣ *Presentation by the RFPG members and the public of flood experience.*

Presenters are thoroughly briefed at the beginning of one-on-one communications with cities and counties, as well as during roadshows, to ensure their discussion of historic flooding experiences is structured and comprehensive. For the 1% storm event, detailed maps are presented and discussed, enabling presenters to provide a guided tour of the general or specific locations where damages or issues were observed and highlighted in the analysis. These maps serve as a visual aid to facilitate meaningful discussions and pinpoint areas of concern. During the presentation, a map is displayed to indicate the locations being discussed, ensuring alignment between the presenter’s experiences and the analysis findings. Meanwhile, RFPG technical consultant staff actively take notes, capturing brief descriptions of the flood-related problems experienced for each storm and location to ensure no critical details are overlooked.

Following the presentation, RFPG technical consultant staff engage in a deeper discussion to explore broader issues that extend beyond specific flood events. These discussions focus on:

- Primary public concerns
- Adequacy of early warning
- Issues with emergency route/ critical facility access
- Post-flood cleanup issues
- Issues with agency coordination

This structured approach ensures that both localized and systemic issues are documented, providing a robust foundation for addressing community needs in the regional flood planning process.

Develop a short description of each problem that defines a need.

After each one-on-one communication with cities and counties, as well as the roadshows, the identified problems are carefully analyzed and reformulated into clearly defined needs relevant to the region. In addition to these discussions, the results of public surveys are thoroughly reviewed to capture broader community input and ensure that the voices of residents are reflected in the planning process. This combined approach ensures that the concerns raised by stakeholders and the public are accurately captured and aligned with the broader goals of regional flood planning. By translating these problems and survey feedback into actionable needs, the RFPG can better prioritize and address the challenges faced by communities across the region.

Propose FMEs and FMSs to address the need.

During the public meetings, drainage issues and challenges are discussed along with identifying potential FMEs and FMSs.

Process for Identification of Potentially Feasible FMPs

Potentially feasible FMPs comprise the subset of the full list of regional FMPs that are to be carried forward for technical evaluation and considered for recommendation in the RFP. A recommended process was introduced during Cycle 1, which involves developing plans for each of two scenarios:

1. FMPs that are currently listed in an active SWMP. An active SWMP is defined as current planning for future funding of selected storm water infrastructure projects, where the projects have been identified, planned (i.e. undergone concept design and cost estimation), and prioritized via a public process.
2. Other potential FMPs identified by the RFPG process and the public

Identification of Potentially Feasible FMPs via an active SWMP

To date, the RFPG has identified four SWMPs: a list of 139 storm water mitigation projects developed by El Paso Water for the City of El Paso, and a list of 66 storm water mitigation projects developed by El Paso County and one project for City of Alpine and for Presidio. The recommended process for identifying potential FMPs from these three SWMPs is:

- Address all projects within each SWMP as a separate group.
- Consult with each entity if any of those FMPs presented at Cycle 1 were constructed recently, if this is the case those projects will be removed.
- Perform consultation with each entity and discuss which projects should be included as part of Cycle 2.
- The RFPG technical consultant will re-rank projects using the Cycle 1 ranking system as a foundation-previously reviewed and approved by the RFPG-. Following the re-ranking process, the RFPG will review the updated project list and select the projects-termed "Potentially Feasible FMPs"-that will undergo further evaluation. It is anticipated that the scores derived from this ranking system will help limit the number of projects carried forward into the next evaluation phase.

By consulting with relevant entities and removing any projects that have been recently constructed, the RFPG aims to select only the most promising, "Potentially Feasible FMPs" for further technical evaluation and recommendation in the RFP. This comprehensive approach ensures that the focus remains on projects with the highest potential to meet regional needs for storm water infrastructure funding.

Identification of Potentially Feasible FMPs not included in an active SWMP

The recommended process for identifying “potentially feasible FMPs” from the identified full list of projects not included in an active SWMP is:

- Create a list of regional projects not included in an active SWMP.
- Apply FMP scoring method to score each project in the regional list
- The RFPG will select "Potentially Feasible FMPs" from the list using the developed project scores

Create a list of regional projects not included in an active SWMP.

To date, the RFPG has identified potential FMPs developed outside of a SWMP process by these entities:

- USIBWC
- EPCWID No. 1
- US Army Corps of Engineers (USACE)
- Texas Department of Transportation (TXDOT)
- Others (3 counties, and a water supply project by El Paso Water)

FMP scoring method developed for Cycle 1.

The following two lists of project scoring categories were voted upon and approved by the RFPG on 12/16/21. These lists derive from similar lists of categories used in the City of El Paso SWMP, with added categories available through information provided to the RFPG by the TWDB.

The first list, shown below in **Table 10**, is a list of project benefits to be qualitatively compared between projects. These categories were assigned a range of potential scoring points per subcommittee judgement of the relative importance of each category.

Table 10: Proposed Benefit Categories and Data Sources

Source	Benefit Category	Current Data Source	Range of Potential RFPG Scoring Points	
			No Benefit	Provides Benefit
City of El Paso SWMP	Increase Dam Safety	National Inventory of Dams, Chapter 299 TWC	0	4
	Reduce Flooding of Property	Best available risk maps, TWDB structure inventory	0	3-4
	Remove 100+ Properties from the Flood Zone	Best available risk maps, TWDB structure inventory	0	4
	Reduce Flooding of IH-10	FMP location versus IH-10	0	1-3
	Reduce Flooding of Major Arterial Roadways	Road classification database	0	3
	Reduce the Risk Associated with Debris Flow	Review of aerial photography to ID mobile bed arroyo	0	3-4
	Reduce Maintenance	Review of aerial photography to ID mobile bed arroyo	0	1-4
	Reduce Nuisance Flooding	Review of likely flat terrain-related routine flooding	0	2
TWDB	Reduce # of low water crossings in floodplain	TWDB dataset	0	1-3
	Reduce # of vulnerable buildings in floodplain	TWDB dataset	0	1-3
	Reduce # of critical buildings in floodplain	TWDB dataset	0	1-4

The second list, shown below in **Table 11**, is of federal, state, and local agencies with potential permit authority. The difficulty of obtaining an agency permit for each project will be qualitatively judged, adding a positive or negative score adjustment to each project.

Table 11: Agencies with Permit Authority

Permit Agency	
Railroad Permit	Texas Parks and Wildlife
IBWC	Historic District / Archaeologic
TCEQ	Land Acquisition
USACE	Street, Utility and Amenities Reconstruction
EPCWID #1 / EBID Permit	Environmental Impacts
TxDOT Permit	Other Ordinances (Parks, Unexploded Ordinances, Open Space)
Fort Bliss Permit	
Scoring Adjustments for Permit Required: Yes (-1), No (0)	
Scoring Adjustments for Permit Complexity: Easy (+1), Normal (0), Difficult (-1), Unknown (-2)	

‣ *Apply FMP scoring method to score each project in the regional list.*

For each project, the scoring method will consider:

- Total scored benefits from **Table 10**
- Total score adjustments from **Table 11**
- The total score when adding the scored benefits from **Table 10** to the score adjustments from **Table 11.**
- After scoring each project, the list of projects is sorted in order of descending score value.

‣ *Select Potentially Feasible FMPs based on Project Scores.*

The last step in the process is via RFPG consensus, select “Potentially Feasible FMPs” from the sorted list using the developed project scores.

Secondary Process for Identification and Selection of Potential FMEs, FMSs, and FMPs

The estimation of region-wide 1% AC flood risk has identified a number of regional locations outside of El Paso County with high numbers of estimated structures-at-risk. In general, the data collection process for the RFP has identified incorporated and unincorporated areas outside of El Paso County with stakeholders who have presented awareness of our plans for addressing this risk. The more significant areas of risk will be discussed with each appropriate local stakeholder, potentially expanding the list of already-planned regional FMPs.

If no FMP or FMS has been previously identified for areas at risk of 1% AC flooding, or if the best available H&H models lack sufficient detail to allow for evaluations of FMPs or FMSs, then an FME to develop detailed H&H models and evaluate flood mitigation alternatives will be selected for the at-risk areas. The RFPG technical consultant will review the higher risk areas identified by Task 2A and assign FMEs to these areas, so that these FMEs can be performed at a later date to identify potential FMSs and FMPs in future RFP cycles. Based upon recommendations from the RFPG technical consultant, the RFPG will vote for approval of the potential FMEs.

List of Potential FMEs, FMSs, and FMPs

- FMEs, FMSs, and FMPs identified for further evaluation in the Upper Rio Grande RFP are listed **Table A12, A13,** and **A14** respectively (reference the Attachments section). These flood reduction actions were identified based on needs defined through stakeholder coordination via meetings, phone calls, surveys and/or planning documents provided to the RFPF technical consultant. Before detailed evaluations of flood reduction actions are performed, the RFPG will approve the potential FMEs and potentially feasible FMPs and FMSs via the processes described in this Tech Memo. At this time, the RFPG has not voted to characterize any FMEs, FMSs, or FMPs as infeasible.

Attachments